

What is claimed is:

[Claim 1] 1. A method for controlling a wheel drive system of a hybrid electric vehicle when starting a power source, the hybrid electric vehicle having first and second power sources, a motor configured to be driven by the first and/or second power sources, and a power transfer unit having a plurality of gear ratios, the power transfer unit configured to be driven by the motor to drive a vehicle wheel, the method comprising:

determining whether the first power source is to be started;
determining whether a level of torque requested by a vehicle operator is greater than a threshold value if the first power source is to be started and the hybrid electric vehicle is in motion;
maintaining a current gear ratio if the level of torque requested by the vehicle operator is greater than the threshold value; and
providing a target level of torque with the motor while the current gear ratio is engaged.

[Claim 2] 2. The method of claim 1 wherein the step of determining whether the level of torque requested by the vehicle operator is greater than the threshold value further comprises determining whether the level of torque requested by the vehicle operator is less than an upper limit value.

[Claim 3] 3. The method of claim 1 wherein the current gear ratio is maintained for a predetermined period of time.

[Claim 4] 4. The method of claim 1 wherein the first power source is an internal combustion engine selectively coupled to the motor via a clutch.

[Claim 5] 5. The method of claim 1 wherein the second power source is a battery.

[Claim 6] 6. The method of claim 1 wherein the level of torque requested by the vehicle operator is based on a signal from an accelerator pedal position sensor.

[Claim 7] 7. The method of claim 1 wherein the threshold value is based on the current gear ratio of the power transfer unit.

[Claim 8] 8. The method of claim 1 wherein the step of determining the target level of torque based on the current gear ratio and the level of torque demanded by the vehicle operator.

[Claim 9] 9. A method for controlling a wheel drive system of a hybrid electric vehicle during a rolling start, the hybrid electric vehicle having first and second power sources, a motor adapted to be powered by at least one of the power sources, and a power transfer unit having a plurality of gear ratios, the power transfer unit being adapted to be driven by the motor to drive a vehicle wheel, the method comprising:

- determining whether to start the first power source;
- determining whether a level of torque requested by a vehicle operator is greater than a threshold value indicative of a level at which a power transfer unit gear ratio downshift would be desired;
- inhibiting a downshift to a lower gear ratio for a predetermined period of time; and
- providing an additional amount of torque to the vehicle wheel with the motor and second power source while the downshift to the lower gear ratio is inhibited.

[Claim 10] 10. The method of claim 9 wherein the step of providing an additional amount of torque includes determining an amount of torque that would be available if the target gear ratio were engaged.

[Claim 11] 11. The method of claim 10 wherein the additional amount of torque is equal to the amount of torque that would be available if the target gear ratio were selected.

[Claim 12] 12. The method of claim 9 wherein the motor is a starter-alternator.

[Claim 13] 13. The method of claim 9 wherein the predetermined period of time is less than or equal to 3 seconds.

[Claim 14] 14. The method of claim 9 wherein the level of torque requested by the vehicle operator is based on a signal from an accelerator pedal position sensor.

[Claim 15] 15. A method for controlling a wheel drive system of a hybrid electric vehicle during an engine start, the hybrid electric vehicle comprising an engine, a voltage source, a power transfer unit adapted to drive a vehicle wheel and having a plurality of gear ratios, a motor-generator selectively coupled to the engine via a first clutch, selectively coupled to the power transfer unit via a second clutch, and adapted to be powered by at least one power sources, the method comprising:

- determining whether an engine start-up is requested while the hybrid electric vehicle is moving;
- determining whether a level of torque requested by a vehicle operator exceeds a threshold value associated with a current gear ratio;
- starting a timer;
- inhibiting a gear ratio shift of the power transfer unit;
- starting the engine;
- calculating an amount of torque to provide to the power transfer unit while in the current gear ratio;
- providing the amount of torque to the power transfer unit with the motor-generator while the engine is being started; and
- repeating the inhibiting, calculating, and providing steps until a predetermined period of time measured by the timer has elapsed.

[Claim 16] 16. The method of claim 15 wherein the step of determining whether the level of torque requested by the vehicle operator exceeds the threshold value further comprises permitting a shift from the current gear ratio to a target gear ratio if the level of torque requested exceeds a limit value indicative of a wide open throttle condition.

[Claim 17] 17. The method of claim 15 wherein the step of calculating the amount of torque to provide to the power transfer unit is based on the current gear ratio, a target gear ratio that would be engaged if a gear ratio shift were permitted, and the level of torque requested by the vehicle operator.

[Claim 18] 18. The method of claim 15 wherein the level of torque requested by a vehicle operator is based on a signal from an accelerator pedal position sensor.

[Claim 19] 19. The method of claim 15 further comprising engaging the first clutch while the engine is being started.

[Claim 20] 20. The method of claim 15 further comprising engaging the second clutch after the engine has started.